

SOIL SURVEY OF SHELBY COUNTY, MISSOURI.

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LOCATION AND BOUNDARIES OF THE AREA.

Shelby County is of rectangular form, with the indication of a panhandle in the extreme southwest corner. It is located in the north-eastern part of Missouri and comprises an area of 511 square miles. It is bounded on the north by Knox and Lewis, on the east by Marion, on the south by Monroe, and on the west by Macon counties. It is well watered by the South Fabius and Salt rivers, and by a large

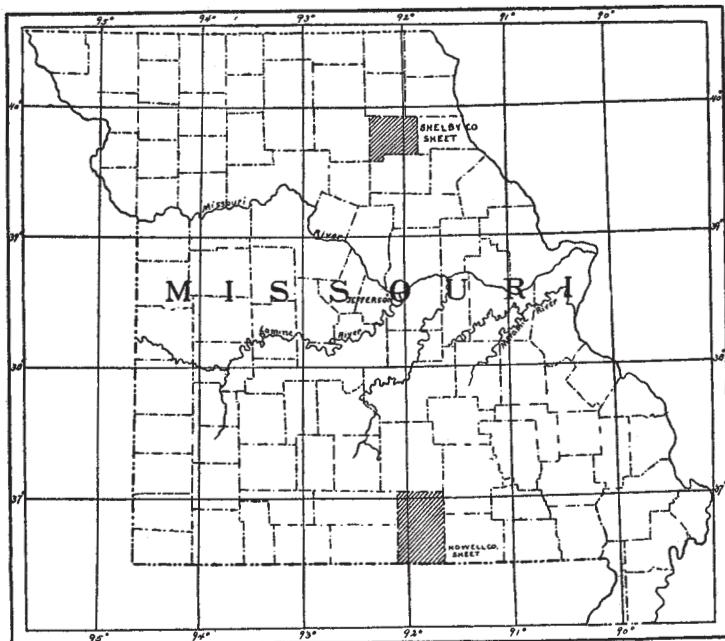


FIG. 43.—Sketch map showing location of the Shelby County area, Missouri.

stream known as Black Creek. It includes the towns of Shelbina, Shelbyville, Clarence, Bethel, and a number of smaller villages.

An old county map was used as the base map of this survey, and was found fairly correct, except in Tiger Fork Township, where a few corrections were made to enable a more accurate location of the soil boundaries.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

In 1803 the United States acquired the Territory of Louisiana, including a vast extent of country lying west of and along the Mississippi River. County organization covering the area surveyed was first established with the erection of St. Charles County in 1812, but it was not until 1835, and after several subdivisions of this county had been made, that Shelby County was established with its present boundary lines.

The first permanent settlement was not made until after 1830, when a pioneer from Monroe County settled near the mouth of Black Creek. He brought with him a drove of hogs to feed on the wild mast then so plentiful. After this other settlers came in slowly, and located largely south of the present town of Oakdale. The lands along the rivers and their tributaries were heavily timbered. These lands were selected by the early settlers in preference to the open prairie lands, which, owing to lack of timber, were esteemed unproductive and worthless.

In 1833 there were 26 families in the neighborhood of Oakdale. The lands had proven very productive. Wheat at that time was a certain crop, while corn, flax, and hemp did remarkably well. Stock flourished on the prairie from early spring until June, by which time the grass became very dry. It was the practice then to burn the prairies, after which the cattle would come from miles around and feed on the young, nutritious shoots.

Some time between 1837 and 1840 the prairie was first broken. This breaking was usually done with from 10 to 20 yoke of oxen, owing to the heavy sod of the prairie grass. The plows of the time were of primitive character, all having wooden moldboards, with sometimes an iron point, although in the light bottom soils a forked stick was frequently used.

In 1840 the population of the county was a little more than 3,000. In 1842 and 1843 money was very scarce, while wages and the price of agricultural products were extremely low, and times were very hard. A contemporary report of the St. Louis market gives the following quotations:

Flour, \$2.50 a barrel; wheat, 35 to 45 cents a bushel; ham, 5 cents a pound; pork, \$1.50 a hogshead; beef, \$1 a hundred pounds; coffee, 10 cents a pound; sugar, 7 cents a pound; tobacco of the best quality, \$3.10 a hundred pounds. During this period no land could be sold, as the Government only received \$1.25 an acre for land entered under the preemption law, of which land there were wide areas still unclaimed.

In 1845 a colony of Germans from Ohio and Pennsylvania settled on the present site of Bethel. They entered large tracts of land, and started the towns of Elm and Mamre.

After 1842 the production of wheat declined in importance, and this crop came to be looked upon as an uncertain crop, although good yields were still secured from new land. The price of hemp became so low that tobacco was substituted. This crop had the advantage of a ready sale, even if the price was low.

Up to this time the stock interests were being gradually developed. A number of farmers were engaged in breeding and raising stock, and this industry has since become the dominant interest in the area.

From 1846 to 1855 great effort was made to bring the Hannibal and St. Joseph Railroad through the county. The construction of this road began when the legislature tendered the company a loan. In 1856 the work was partially completed, and trains ran from Hannibal to Palmyra. Traversing the southern part of the county, it resulted in the founding of the towns of Hunnewell, Lakenan, Shelbina, and Clarence, and greatly increased the population, general prosperity, and wealth of the county.

During the civil war there was little improvement in general conditions, and the county was in a most unsettled state. Very few settlers found their way to the county during this period.

After the war, and up until the panic of 1873, the county enjoyed a period of renewed prosperity. This panic again brought hard times, and there was a general and sharp decline in wages and prices. Whether because of the panic or not can not be stated, but immigration practically ceased. In the last three years, however, there has been a great influx of settlers from Iowa and Illinois, and it is estimated that 80 per cent of the land has changed hands during this period.

CLIMATE.

In Shelby County there are no observation stations, and the data below were compiled from the official records of the Weather Bureau at Hannibal and Palmyra. These consist of normal monthly and annual temperature and precipitation. They represent the means of averages of several years.

From these records it would appear that the county enjoys moderate temperature and an even distribution of precipitation. Local observers report an almost continuous wind movement, more particularly from the west, and that the months of July and August are usually characterized by somewhat droughty conditions, accompanied by hot winds.

The late spring and early fall killing frosts from year to year are very erratic. In the last ten years at Hannibal the late spring frosts occurred from March 27 to May 14; and at Palmyra from April 3 to May 14. This gives an average for both stations of April 24. At

Hannibal the early fall frosts occur from September 20 to November 8, and at Palmyra from September 18 to November 7, October 15 being the average date.

Normal monthly and annual temperature and precipitation.

Month.	Hannibal.		Palmyra.		Month.	Hannibal.		Palmyra.	
	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.		Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.
January	25.9	1.62	29.7	2.40	August.....	74.2	2.13	78.5	2.28
February	30.5	1.79	27.2	2.44	September ..	66.7	2.78	70.2	3.48
March	39.5	2.48	39.3	3.22	October	55.0	2.58	57.3	2.56
April	53.7	2.41	55.5	2.62	November ..	40.2	2.01	41.6	2.35
May	63.1	4.89	66.9	5.04	December	31.9	1.50	30.1	2.19
June	72.4	4.06	76.9	4.54	Year...	52.5	31.84	54.4	37.20
July	76.7	3.59	80.0	4.08					

PHYSIOGRAPHY AND GEOLOGY.

Shelby County lies in a physiographic division known as the Upland Plain of Missouri, and locally in the prairie region. It has an average altitude of about 800 feet, and slopes to the southeast. The surface is level and gently rolling, dropping rather abruptly to the important stream courses. These are usually marked by narrow bottoms, but sometimes the banks rise abruptly from the stream beds. The streams have cut their way to moderate depths rather rapidly through the unconsolidated strata.

The general drainage is east and southeast, by way of the Fabius River, Tiger Fork Creek, Black Creek, Salt River, and the Mississippi to the Gulf of Mexico.

The intermittent tributaries of the streams within the county are gradually heading farther and farther back into the uplands, and are marked by deep ravines.

The underlying rock of Shelby County consists largely of the limestones of the Subcarboniferous period. In the southeastern part of the county is a portion of one of the eastern basins of the Coal Measures, while the largest basin in the State touches the western boundary of the area. In these Coal Measures are found local strata of interbedded shale, some of which are exposed northeast of Lakenan.

In the upper strata of the limestones in the eastern and northeastern parts of the county are found thin beds of white chert. These break up into angular fragments, and are scattered through the overlying glacial drift.

All these rocks have very little influence on the soils of the area, as they are exposed only where erosion along some of the important water courses has laid them bare.

According to Leverette (U. S. Geological Survey Monograph XXXVIII), this area is included in the area of glaciation. The drift, as it overlies the limestone, is classified by him with the Kansan, while the gummy, adhesive clay he states is closely related to the loess, and is referred to the same epoch—one of low altitude and more or less submergence.

In the description of the Quaternary formations by James E. Todd, of the Missouri State Geological Survey, the surface conditions of this area are attributed to the great ice invasion. He states that above the residual clays of the carboniferous limestones occurs a division of unstratified joint clay, with occasional boulders of red granite from the Laurentian of Canada and erratics from Minnesota, with fragments of the carboniferous rock of local origin. Above this occurs the division of modified drift. This consists of sandy clay, with occasional pockets of stratified gravel. It does not occur at high levels, but is exposed through erosion. It has been found in this position throughout the entire county, underlying the prairie and giving rise to an important soil type.

The upland deposits are considered by Todd the equivalent of the loess, although the line of demarcation between the typical loess of the high lands near the important streams and the loamy clay of the uplands to the north of the Missouri River is not well defined.

SOILS.

Four types of soil, exclusive of Meadow, are found in Shelby County. The following table gives the area of each:

Areas of different soils.

Soil.	Acres.	Per cent.
Shelby silt loam.....	216,896	66.3
Shelby clay	71,168	21.7
Meadow.....	36,416	11.1
Jackson loam	2,304	.7
Shelby sand.....	448	.1
Total	327,232

SHELBY SAND.

The Shelby sand has the least area of any of the types surveyed in Shelby County. It is a brown or yellow sand to sandy loam of fine to medium texture, with a depth of 10 inches, grading into reddish-yellow sand of medium texture, which is underlain at depths ranging from 24 to 36 inches by sandstone in place.

This type occupies the sloping uplands just above some of the second bottoms. The subsoil is composed of material derived from the underlying sandstone, while the soil is the result of the upland wash, reworked with the underlying sand.

This type has too limited a distribution to form any definite idea of the average yield of crops grown upon it. It is usually included in the same fields with the Shelby clay, and used for the same crops. It is best adapted to the production of early truck, cane, stone fruits, and wrapper tobacco.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Shelby sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
10144	2 miles NE. of Lakenan.	Sandy loam, 0 to 10 inches.	P. ct. 1.40	P. ct. 1.36	P. ct. 6.90	P. ct. 9.76	P. ct. 30.30	P. ct. 14.28	P. ct. 28.42	P. ct. 8.88
10145	Subsoil of 10144...	Brown sand, 10 to 40 inches.	.81	1.96	9.30	15.62	42.84	9.22	11.08	9.84

JACKSON LOAM.

The Jackson loam is a light loam, with an average depth of 14 inches, grading into a sandy clay or clay subsoil. The color of the subsoil is variable, but it is usually mottled with grays and drabs.

This type has a very limited distribution, occurring in patches along the larger water courses and occupying the second bottoms. It is of alluvial origin, forming part of a former flood plain, and has a level to gently rolling topography. It is usually more sandy as it approaches the present water courses, and increasingly heavier as it nears the uplands.

This soil is used for the production of wheat, corn, grass, truck, and fruits. The average yield of wheat per acre is 15 bushels and of corn from 25 to 40 bushels. Onions yield as high as 300 bushels to the acre, judging from the yield in the one instance in which this crop was found. This type is admirably adapted to light farming crops, truck, wrapper tobacco, and corn, and from the few peach and plum trees observed it would doubtless prove a good soil for these fruits.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Jackson loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.		Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
				P. ct.	P. ct.						
10142	5 miles E. of Shelbina.	Loam, 0 to 14 inches.	P. ct.	1.96	0.00	0.36	0.40	15.60	25.32	48.58	9.74
10140	2 miles S. of Nelsonville.	Light loam, 0 to 14 inches.	P. ct.	2.25	.28	.74	.42	7.52	26.98	50.34	18.72
10143	Subsoil of 10142....	Light sandy clay, 14 to 36 inches.	P. ct.	.64	.04	.40	.90	26.00	24.76	37.24	10.66
10141	Subsoil of 10140....	Loam, 14 to 36 inches.	P. ct.	.61	.80	1.72	.62	7.80	23.54	49.94	15.58

SHELBY CLAY.

The Shelby clay typically consists of a fine sandy or silty loam, of a gray or brown color, with a depth of from 3 to 8 inches, grading into a reddish-yellow sandy clay that extends to a depth of 3 feet or more.

The Shelby clay, more commonly known as the "white-oak lands," occurs largely in Tiger Fork, the eastern part of Black Creek, Clay, and the western part of Taylor, and to a lesser extent in Salt River townships.

There is a variation of this type where the subsoil is a stiff, heavy, clay. This was included with the Shelby clay, for the reason that the areas were very limited and did not warrant the establishing of a separate type.

In the typical areas, at the point of transition of the soil into the subsoil, iron pipes and concretions are usually found. The soil particles are angular in shape. The subsoil in general is of a massive structure and a somewhat heterogeneous character. It is made up largely of minute pockets of sand and clay, with an occasional thin lens of cherty gravel. The gravel varies from one-fourth of an inch to 1 inch in diameter. A few boulders of local or foreign origin also occur in the subsoil throughout the areas of this soil.

This soil is of glacial origin, and belongs to the division known as the Loamy Drift. This material lies immediately below the Shelby silt loam, and is exposed through stream cutting and through erosion of the prairie clay. As a consequence, this type occupies the steeper slopes and the rough and broken country adjacent to the water courses.

The deviation from the type already noted is found on ridges which

have been isolated from the upland by the encroachment of the minor streams. These ridges were once covered by typical Shelby silt loam, which is still the type in such position in Tiger Fork Township. Through continuance of stream erosion and general surface washing, the characteristics of the Shelby silt loam are obliterated and the heavier phase of the Shelby clay results. This variation occupies the narrow, trailing divides, and occurs only as a local variation in the white-oak lands.

Probably less than one-third of this type is under cultivation, and this largely east of Shelbina and Bethel. The greater portion is covered with a growth of white and scrub oak, with a scattering of red oak and hickory.

The Shelby clay was the land first taken up by the early settlers, and it produced good crops of wheat, corn, flax, hemp, and tobacco, and formed fine pasture lands. Upon the recognition later of the productivity of the prairie land (Shelby silt loam), the former type was gradually abandoned, and now, with the exception of a few clearings, it is not cultivated. Where cultivated, wheat, corn, and grass are the principal crops. As on the other soils of the area, no definite rotation is practiced. It is held in corn for four years or more, when wheat, which is the nurse crop for timothy and clover, is sown. It remains in pasture for indefinite periods. More often this type is used altogether for pasturage, while the bottoms are used for cultivated crops.

The following yields per acre are obtained on the Shelby clay: Wheat, from 8 to 35 bushels, with 10 bushels as an average; corn, from 12 to 35 bushels, with an average of 25 bushels; and tobacco, from 700 to 900 pounds.

Much more wheat is produced on this type than on the Shelby silt loam, for the reason that it gives more certain results than the latter soil. Corn produces fairly well, considering the methods of cultivation in use, and is said to be of better quality than that grown on prairie lands. The pasturage is esteemed the best in the area. Blue-grass appears to be indigenous, for upon clearing the soil this grass comes in naturally.

The following table gives mechanical analyses of fine earth of typical samples of this soil:

Mechanical analyses of Shelby clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.		Coarse sand, 1 to 0.5 mm.		Medium sand, 0.5 to 0.25 mm.		Fine sand, 0.25 to 0.1 mm.		Very fine sand, 0.1 to 0.05 mm.		Silt, 0.05 to 0.005 mm.		Clay, 0.005 to 0.0001 mm.	
				P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	
10134	3 miles NE. of Lakenan.	Light loam, 0 to 4 inches.	0.96	1.26	5.38	5.88	15.34	9.92	58.16	8.84							
10138	1½ miles NE. of West Springfield.	Light loam, 0 to 3 inches.	1.12	1.78	6.08	6.98	21.20	14.50	34.04	15.08							
10136	2½ miles W. of Hagers Grove.	Light loam, 0 to 4 inches.	1.57	1.96	5.60	7.02	19.96	15.40	33.14	16.06							
10135	Subsoil of 10134....	Sandy clay, 4 to 36 inches.	.29	1.54	6.06	5.86	13.88	.9.86	30.00	32.78							
10137	Subsoil of 10136....	Sandy clay, 4 to 36 inches.	.44	1.74	4.16	5.40	13.24	9.86	24.80	40.80							
10139	Subsoil of 10138....	Sandy clay, 3 to 36 inches.	.77	1.04	5.14	5.92	13.32	9.84	19.52	45.14							

SHELBY SILT LOAM.

The Shelby silt loam is a silty loam with a depth varying from 6 to 10 inches, grading into a stiff, dense, impervious silty clay, plastic and waxy when wet, friable and loamy when dry, and of exceedingly uniform texture in all parts of the area surveyed.

The color of the soil depends upon its moisture content. When dry the color ranges from light to dark gray; when wet it assumes a darker gray color. The subsoil is characterized by a dark-mottled clay, with brown or drab as a base, streaked with blue and red. At greater depths it assumes the lighter colors of gray, blue, or yellow, attributed to the presence of iron and lime compounds. In the stream or road cuts, where the subsoil is exposed, the loss of the mechanically-held water by evaporation results in the formation of cracks through a shrinkage or contraction of the soil mass. These cracks are of all sizes, and of roughly circular shape. The soil in such places is largely made up of cubes, which, upon further drying, become an almost impalpable powder.

The Shelby silt loam, commonly known as the prairie, is found over large, uniform areas of the county, more particularly in the southern tier of townships. It also occurs in Bethel and Taylor townships, and in smaller isolated areas in Tiger Fork Township.

Over most of the area of this soil type the surface drainage is fairly good, but the impervious nature of the subsoil tends toward the accumulation of water on the more level areas during heavy rains. This

has generally led the farmers of this section to believe in the presence of an underlying hardpan.

The Shelby silt loam occupies the level to gently rolling uplands, which become more rolling as they approach the water courses. It is supposed to be of loessial origin and is referred to the same epoch as the typical loess of the river bluffs.

In general this type is easy to cultivate, although the surface soil is comparatively shallow, as the depth of plowing rarely exceeds 7 inches. A puddled condition always follows the tramping of stock, which, when there is a lack of roughage, are frequently turned into the "stalk fields" after the corn has been husked.

The original vegetation on this soil was prairie grass, which is found now only in insignificant patches along the roads or on the wooded valley slopes. Within the memory of some of the older settlers, the swamp white oak, pin oak, elm, and hickory have grown up along the main streams, while the original forests, along the main water courses, have encroached on the eroded portions of the type, where the growth is now white and scrub oak. The general lack of timber in former times on the prairie was supposed to be the result of the continued burning of the prairie grass by the Indians and early settlers. The chief crops now grown are hay, corn, oats, and wheat, with such accessories as German or Hungarian millet, Kafir corn, and sorghum. Usually near the houses are a few apple trees. The following yields are secured on this soil in good seasons: Hay, from 2 to 3 tons; corn, from 35 to 40 bushels; oats, 30 to 60 bushels; wheat, 15 to 20 bushels, but uncertain; Kafir corn, 20 to 40 bushels; millet, 30 to 40 bushels of seed per acre.

The Shelby silt loam is a typical grass soil. In most sections of the East timothy requires a catch crop, but on the Shelby silt loam one is not necessary, although the seed is sometimes sown in the fall with wheat, or in the spring with oats. The fact that this crop succeeds so well when planted alone makes the production of seed very profitable.

The production of oats on this type is more favored than that of wheat. The crops are surer and the yields are above the average for the country. Wheat and clover have a tendency to heave and to winter-kill. This is likely the result of prevailing methods of cultivation, for with the incorporation of manure, and deeper plowing, there is little difficulty in getting stands of these crops. The supply of organic matter is usually maintained by turning under timothy meadows, upon which the stock are usually pastured and fed. The soil, however, is rapidly deteriorating, having been cultivated for years in corn without rotation.

Of the fruits, apples, pears, and plums are successfully grown. The production of apples is attaining some importance. The Ben Davis is the favorite variety.

The following table gives mechanical analyses of typical samples of this soil:

Mechanical analyses of Shelby silt loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.		Coarse sand, 1 to 0.5 mm.		Medium sand, 0.5 to 0.25 mm.		Fine sand, 0.25 to 0.1 mm.		Very fine sand, 0.1 to 0.05 mm.		Silt, 0.05 to 0.005 mm.		Clay, 0.005 to 0.0001 mm.	
				P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	
10128	1 mile E. of Lentner.	Clay loam, 0 to 8 inches.	1.45	0.08	0.70	0.48	0.92	2.70	75.54	19.02							
10130	3 miles W. of Shelbyville.	Clay loam, 0 to 10 inches.	2.91	.30	1.54	.72	1.00	2.04	75.08	19.24							
10126	3 miles N. of Bethel.	Clay loam, 0 to 8 inches.	2.60	.70	2.32	1.64	1.50	3.36	70.50	19.78							
10127	Subsoil of 10126....	Mottled heavy clay, 8 to 36 inches.	1.37	.72	2.64	1.28	1.50	2.10	58.04	33.54							
10129	Subsoil of 10128....	Mottled heavy clay, 8 to 36 inches.	.46	1.22	2.50	.84	1.00	1.86	53.66	38.84							
10131	Subsoil of 10130....	Mottled heavy clay, 10 to 36 inches.	1.18	.60	2.06	1.20	2.10	2.02	52.46	39.54							

MEADOW.

The term Meadow as used in this report is not to be confused with what is commonly known as grass lands in this area. It is a name used as a description of a soil condition, irrespective of texture. Areas mapped as Meadow comprise the poorly drained areas adjacent to water courses, or land subject to overflow or hill seepage.

The alluvial deposits of the first two classes are commonly known as gumbo, crawfish land, and sandy bottoms. These owe their origin to the wash or erosion and subsequent deposition of material of the glacial uplands, the texture being dependent upon the velocity of the current during sedimentation. Many of these areas are not at present subject to overflow, but are cold and wet and in need of artificial drainage. They are largely used as permanent pastures, although when better drainage has been established, or in suitable seasons, corn will yield from 50 to 60 bushels and hay from 2 to 3 tons to the acre, although of coarse and woody texture. For this reason the hay is not so much esteemed as that produced on the uplands.

In the area of the Shelby clay, the bottoms are more often of sandy texture. The hills in such places are rarely cultivated and are used for pasture, while the bottoms are farmed.

The advantages of more perfect drainage can not be overestimated. A ditcher has been successfully used in the construction of drains, and areas that formerly were almost swamps have been reclaimed and are yielding very profitable returns.

AGRICULTURAL CONDITIONS.

The practice of the early settlers of ranging their cattle on the prairie was the initial step which has since led to the great development of the stock interests of this section. The advent of improved transportation facilities later placed Shelby County between the feeding States of the East and the more westerly States given up to ranges, and the increase in land values, concurrent with the increase in population and the westward movement of the great markets, has made it unprofitable to use the lands for range purposes, but has encouraged agricultural production as subsidiary to the stock interests. The chief products of the field are thus hay and corn, of which a comparatively small proportion is shipped out of the county, the major portion being converted into the less bulky form of beef and pork.

The greater part of the county is composed of grass land of more than ordinary productiveness. It is not uncommon to see 10 or 15 hay stacks or ricks in one field, or a hundred within the range of vision. In these same meadows are usually found large droves of mules, horses, cattle, and hogs. The cattle consist largely of Aberdeen, Angus, Hereford, and Shorthorn breeds, with their crosses and grades, while the hogs are principally Duroc-Jersey and Poland-China, with crosses and grades of these breeds.

In general, the county presents the appearance of thrift and prosperity. The farm buildings and other improvements are of a substantial character, and the farmers enjoy many comforts often wanting in agricultural communities. The best conditions are found within the area occupied by the Shelby silt loam, and the worst on the Shelby clay, or "white-oak lands."

The houses upon the Shelby silt loam are usually neat frame structures of two stories, surrounded by small buildings for the accommodation of the work stock and a dairy cow or two, with room for the storage of a little hay, corn, and fodder. There are a few large barns in the area. These are rectangular, some having dome-shaped roofs to afford greater storage capacity for the hay. The buildings on the "white oak lands" are smaller, with a general lack of improvements. The houses are usually of the cabin type, made of plastered logs, with brick chimneys. Sometimes the logs are weatherboarded. In some areas, where a larger proportion of the land is under cultivation, the improvements are much better. The domestic water supply is usually drawn from cisterns. There are no dug wells in the area and but few driven wells. These range in depth from 90 to 140 feet. The stock are watered from catch basins in the fields.

The farms are of all sizes, but a great many contain 160 acres. Very few comprise as little as 40 acres, while some cover a whole section or

even more. The fields are usually bounded by osage orange hedges, or rail or patent wire fences.

The land values range from \$8 to \$75 an acre. This is about twice the values two years ago. At that time probably 50 per cent of the lands were encumbered, but the better conditions of recent years have enabled the farmers to pay off a large part of these mortgages, though much of the land has changed hands. This increase in values is attributed to the phenomenal yields of hay and corn in 1901, which attracted the attention of farmers in neighboring States, and brought a great many settlers into the county. About 75 per cent of the farms of the area are operated by the owners. Of the remainder, about one-half are rented for cash and the rest on a share basis. Where a share rent is charged on year-to-year leases one-half of all crops is retained by the landlord. A money rent is more customary in the vicinity of the railroads, where the rate ranges from \$3 to \$5 an acre.

Considerable difficulty is experienced in securing good, reliable help. This is likely due to the attraction of the younger men to St. Louis and Kansas City. Labor receives from \$20 to \$30 a month by the year, or from \$1.50 to \$2.50 a day during harvest. In general the farmers help each other or exchange help.

The agricultural products consist largely of hay and corn, and smaller amounts of oats and wheat, with such minor crops as German and Hungarian millet, sorghum, Kafir corn, and tobacco. Hay is the most important crop of the area, and occupies probably 80 per cent of the improved land. It is largely sown alone in the fall, and less commonly in the fall or spring in a nurse crop of wheat or oats. The first crop is harvested for hay or seed. After this the land is used as meadow pastures from four to eight years, although in some instances these have been known to last for a period of twenty years or more without resowing.

The seed here is harvested by means of a timothy header, and subsequently thrashed by specially constructed machines. A header will top 40 acres a day. This costs from 40 to 50 cents an acre, while the thrashing costs about 8 cents a bushel. An acre will yield from 3 to 5 bushels. The seed varies in value from 75 cents to \$1.50 a bushel. The headed hay this year brought from \$2.50 to \$4 a ton. Unheaded timothy was worth a dollar more. The prices at the shipping points are slightly in excess of these. At times the seed brings about as much as the hay, but both are low as compared with the price of these commodities in other parts of the country. Hay is the main feed for stock, but when hay is short the stock is sometimes turned into the fields from which corn has been husked, and such fields are often leased for this purpose at a low rental. Fifteen cents an acre is about the average rate.

The large yields of hay and the low market price are the chief reasons for the shipment of cattle technically called "short feeders." These cattle are not as fat as those fed on corn and bring a better price. They are turned into the pastures and are allowed free access to the hay stacks or ricks.

Corn usually follows in rotation the breaking of the meadows or the fallow fields. This crop is usually grown for a number of years in succession, often for a period of four or six years, or as long as fair yields are secured. Wheat or oats play little part in the general rotation, being used only as nurse crops for timothy and clover. Of the two crops, oats is by far the more successful, although wheat is preferred on the "white-oak lands." Oats on the prairie is a successful crop, but wheat is a most uncertain one. The acreage of sorghum, millet, and Kafir corn is at present very small, and these crops are of only secondary importance. Tobacco was once a staple crop of this county, but its production has been gradually abandoned on account of the competition with the White Burley of the limestone soils of Kentucky. In late years its growth has been taken up again, and the demand for the home-grown leaf is rapidly increasing.

As has been said, the Shelby silt loam has the largest area of any of the soil types. It is valued at from \$40 to \$80 an acre, depending upon location and the character of the improvements. The best general soil conditions are found as the distance from the railroad increases. In the neighborhood of the railroad some hay and corn are shipped to St. Louis. Farther away from the railroad little or no hay or grain is shipped, most of it being converted into beef and pork, which makes little drain on the fertility of the soils.

There is a very general idea that the Shelby silt loam is underlain by a hardpan. The impervious nature of the underlying clay admits only very slow percolation, and after heavy rains the water usually stands upon the more level areas. However, this type is not characterized by wet conditions, though a system of drainage ought to be maintained in many areas to carry off surplus water. In many places the type could be readily tiled, leading the drains into a neighboring waterway, although even surface ditching, with laterals, would be very beneficial. The uncertain yield of wheat is due to this lack of drainage.

An effort ought to be made to inaugurate some definite system of crop rotation. It is doubtful if the manure in the present feed lots does much good. There ought to be a much greater production of straw. If the stock were fed around the straw piles and the manure hauled out it would be a much better practice. As it is now the feed lots are much too large to get the best results for soil or stock.

In addition to better drainage this soil needs deeper plowing and the incorporation of more manure. There should then be found no difficulty in securing a stand of wheat or clover.

The Shelby clay is valued at from \$8 to \$25 an acre. This type suffers from excessive erosion, and unless something is done, in time it will be adapted only to hill pasture. It is suggested that the practice of side-hill cultivation be more generally employed, and that the steeper slopes be terraced at frequent intervals. This would do much to stop the continual loss of soil. At present this type is better adapted to general farming than the Shelby silt loam. It produces fair yields of grass, grain, and the root crops. Stone fruits are produced, but apples do not seem to do very well. Peaches are grown to some extent for home use, but the buds are liable to damage by late spring frosts. This, however, can be obviated by placing roughage around the trees after the ground is frozen, which keeps the sap from circulating until the season of danger is past. Straw placed over frozen ground has been known to keep the ground frozen until as late as June. There is no trouble in securing a stand of wheat and clover on this type. The soil presents fairly good conditions for the production of a filler cigar tobacco.

These soils form nearly the whole of the county. The others are of only minor agricultural importance.

The area is traversed by the Hannibal and St. Joseph division of the Chicago, Burlington and Quincy Railroad, which passes in a northwest direction through the southern part of the county. Bethel, in the northern part of the county, is 13 miles from this line, and more than that from the more northern roads. In many parts of the area it is a long haul to the railroads. Many efforts have been made to secure a branch road to the Iowa line, through the prairie section, but without success. Such a line would run through a very important agricultural country. This would give an outlet for the agricultural products and aid in a greater development of stock interests. As it is, with no competition, freight rates in the county are high. Much better service and better rates to eastern markets can be secured, it is said, on some roads farther west.

During some seasons the county roads are almost impassable. After heavy rains the prairie roads work up axle deep. Their condition is frequently worse in fall and spring, after they have become deeply rutted and then subjected to freezing.

The markets for the area are mainly St. Louis and Chicago. The shipments, as noted before, are mules, cattle, baled hay, and some corn and tobacco.

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